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(54) **Vehicle equipped with an on-vehicle telecommunication system communicating with a user portable communication device housed in a shielding environment**

(57) A vehicle (1) equipped with an on-vehicle telecommunication system (2; 16) having an electromagnetic field shielding case (7) installed in the vehicle (1) and for housing a user portable communication device (3), which has a first communication module (6) permitting, via a first antenna (6a), short-range radio-frequency transmission and reception, and a second antenna (5) permitting long-range radio-frequency transmission and reception to and from a remote radio-base station. The on-vehicle telecommunication system (2; 16) also has a third antenna (8) installed in the shielding case

(7); a second communication module (9) connected to the third antenna (8) to permit, inside the shielding case (7), short-range radio-frequency communication with the first communication module (6) of the user portable communication device (3); and a user interface device (10), which is installed in the vehicle (1), is connected to the second communication module (9), and permits remote use by a user of the user portable communication device (3) to effect long-range radio-frequency transmission and reception to and from the remote radio-base station.

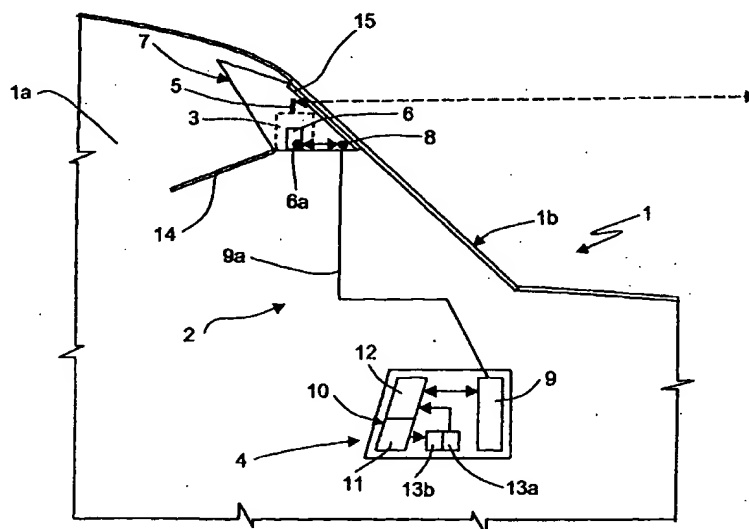


Fig.1

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Description

[0001] The present invention relates to a vehicle equipped with an on-vehicle telecommunication system communicating with a user portable communication device housed in a shielding environment.

[0002] The present invention may be used to advantage, though not exclusively, in automotive applications, to enable a vehicle user, e.g. the driver, to communicate telephonically over a personal cellular telephone, using the on-vehicle telecommunication system, to which application the following description refers purely by way of example.

[0003] In fact, the present invention may be used on any type of transport vehicle equipped with an on-vehicle telecommunication system, e.g. an aircraft, to enable the user of the transport vehicle to communicate over a personal portable communication device using the on-vehicle telecommunication system of the transport vehicle.

[0004] As is known, many last-generation vehicles are equipped with an on-vehicle computer by which a vehicle user, e.g. the driver, can key in various commands to display vehicle travel data, or can dial a telephone number to communicate telephonically with a remote radio-base station using a speaker device integrated in the on-vehicle computer.

[0005] If available, however, the driver of the vehicle very often prefers to use a personal cellular telephone - which the driver is more skilled in using, and which affords a wide range of functions - thus posing serious hazards in terms of road safety.

[0006] To prevent such improper use of cellular telephones, regulations have recently been introduced prohibiting use of cellular telephones by the driver while driving the vehicle.

[0007] Moreover, any telephone communication involving radiofrequency signals is known to be accompanied by the generation of very strong electromagnetic fields, which recent studies have shown to be extremely harmful to human health, especially in the event of prolonged exposure.

[0008] It is an object of the present invention to provide a vehicle equipped with an on-vehicle telecommunication system enabling a user to communicate telephonically over a personal cellular telephone using the on-vehicle telecommunication system, and which at the same time provides for shielding the occupants of the vehicle passenger compartment from electromagnetic radiation generated during such telephone communication.

[0009] According to the present invention, there is provided a vehicle equipped with an on-vehicle telecommunication system; the on-vehicle telecommunication system being characterized by comprising shielding housing means for a user portable communication device, which has first antenna means and first communication means connected to said first antenna means to

permit short-range radio-frequency transmission and reception, and second antenna means permitting long-range radio-frequency transmission and reception to and from a remote radio-base station; said on-vehicle telecommunication system comprising third antenna means installed inside said shielding housing means; second communication means connected to said third antenna means to permit, inside said shielding housing means, short-range radio-frequency communication with said first communication means of said user portable communication device; and user interface means, which are installed in said vehicle, are connected to said second communication means, and permit remote use by a user of said user portable communication device to effect said long-range radio-frequency transmission and reception.

[0010] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows schematically a portion of a vehicle equipped with an on-vehicle telecommunication system in accordance with the teachings of the present invention;

Figure 2 shows a front view in perspective of a shielding case forming part of the vehicle equipped with an on-vehicle telecommunication system as shown in Figure 1;

Figure 3 shows schematically a variation of the Figure 1 on-vehicle telecommunication system;

Figure 4 shows a front view in perspective of a shielding case forming part of the Figure 3 on-vehicle telecommunication system;

Figure 5 shows a schematic view of the Figure 3 shielding case equipped with a horn antenna.

[0011] Number 1 in Figure 1 indicates partly a vehicle equipped with an on-vehicle telecommunication system 2 permitting radio-frequency communication, inside a shielding environment, between an on-vehicle computer 4, installed on vehicle 1, and a user portable communication device 3, and between user portable communication device 3 and a remote radio-base station (not shown). In other words, on-vehicle telecommunication system 2 provides for shielding the occupants of the passenger compartment 1a of vehicle 1 from the electromagnetic fields generated during communication between on-vehicle computer 4 and portable communication device 3, and during telephonic transmission and reception between portable communication device 3 and the remote radio-base station (not shown).

[0012] Portable communication device 3 is preferably, though not necessarily, defined by a cellular telephone, which comprises an antenna 5 preferably, though not necessarily, projecting outwards of the main casing of the cellular telephone, and permitting long-range radio-frequency transmission and reception to and from the remote radio-base station (not shown); and a short-

range radio-frequency communication module 6 which, by means of an antenna 6a, permits short-range radio-frequency communication to a known wireless standard, e.g. the Bluetooth or IEEE 802.11b standard. The cellular telephone is known and therefore not described in detail.

[0013] With reference to Figure 1, in addition to on-vehicle computer 4, on-vehicle telecommunication system 2 also comprises an electromagnetic field shielding case 7 which defines said shielding environment, is located inside passenger compartment 1a of vehicle 1, and houses user portable communication device 3; a first transmitting-receiving antenna 8 housed inside shielding case 7; and a communication module 9 which is connected over a communication cable 9a to first transmitting-receiving antenna 8, and permits, by means of first transmitting-receiving antenna 8, short-range radio-frequency communication with antenna 6a of communication module 6 of user portable communication device 3.

[0014] On-vehicle computer 4 comprises an interface device 10 connected to communication module 6 and allowing the user to remotely enable user portable communication device 3 housed inside shielding case 7, so as to communicate with the remote radio-base station (not shown).

[0015] More specifically, interface device 10 comprises a control device 11, e.g. a keyboard, by which the user imparts commands to on-vehicle computer 4 and/or to user portable communication device 3, such as dialling a telephone number, writing a message for transmission, or any other function typically performed by cellular telephones; a display device 12 for displaying, for example, the number to be dialled, the calling number, or other useful telephone information; a sound pickup device 13a, e.g. a microphone; and a sound reproducing device 13b.

[0016] With reference to the Figure 2 example, shielding case 7 is preferably, though not necessarily, parallelepiped-shaped, and is sized to house user portable communication device 3.

[0017] The walls of shielding case 7 are made of shielding material, such as steel, aluminium, or any material or alloy preventing escape of the electromagnetic waves generated inside shielding case 7.

[0018] With reference to Figures 1 and 2, shielding case 7 also comprises a door 14 enabling access to the inside of shielding case 7 to insert user portable communication device 3 inside the shielding case. To ensure maximum shielding by shielding case 7, door 14 may be fitted with a number of radio-frequency seals (not shown) for optimizing the shielding performance of shielding case 7 when door 14 is closed.

[0019] The body of shielding case 7 has a window 15 transparent to radio-frequency signals, i.e. through which the radio-frequency signals generated by antenna 5 of user portable communication device 3 during communication of user portable communication device

3 with the remote radio-base station (not shown) travel, with no attenuation of the radio-frequency signals. More specifically, window 15 may be defined by an outward opening formed in one wall of shielding case 7, or by an opening closed by any material transparent to radio-frequency signals, i.e. any "non-shielding" material, such as plastic resin or similar materials producing no attenuation of the radio-frequency signals.

[0020] With reference to Figure 1, shielding case 7 may be fixed integrally inside passenger compartment 1a of vehicle 1, so that window 15 faces outwards of vehicle 1 to direct transmission of the radio-frequency signals, i.e. the electromagnetic radiation beam, travelling through window 15, outwards in the opposite direction to the passenger compartment housing the occupants and the electronic systems of vehicle 1.

[0021] More specifically, shielding case 7 may be fitted integrally to an inner wall of the vehicle, at any window or opening "transparent" to radio-frequency signals (any non-shielding window or opening). In the Figure 1 example, shielding case 7 is fixed to the windscreen 1b of vehicle 1, with window 15 facing windscreen 1b, but may obviously be fixed at existing holes or openings in the passenger compartment of vehicle 1, with window 15 facing the holes or openings.

[0022] In actual use, by means of on-vehicle computer 4, the user can enable any function performed by user portable communication device 3 housed inside shielding case 7. In the example shown, the commands entered by the user on keyboard 11 are coded and communicated by on-vehicle computer 4 to communication module 9, by which they are transmitted, in the form of short-range radio-frequency signals, by means of first transmitting-receiving antenna 8.

[0023] Communication module 6 of user portable communication device 3 receives the radio-frequency signals transmitted by first transmitting-receiving antenna 8, and enables the user-requested functions. For example, when telephone communication between portable communication device 3 and the remote radio-base station is enabled, antenna 5 provides for receiving/transmitting, through window 15 of shielding case 7, the long-range radio-frequency signals coding the telephone information, and, at the same time, communication module 6 and first transmitting-receiving antenna 8 provide for short-range radio-frequency transmission and reception of the telephone information, which is thus exchanged with communication module 9 and, therefore, on-vehicle computer 4. Vocal (speaker) communication with the remote radio-base station can be enabled by the vehicle user by means of sound detecting and sound reproducing devices 13a and 13b connected to on-vehicle computer 4.

[0024] On-vehicle telecommunication system 2 is extremely advantageous by ensuring a high degree of protection of the occupants and electronic systems in the vehicle against the electromagnetic fields generated during telephone communication using a cellular tele-

phone inside the vehicle. That is, long-range radio-frequency transmission (between the cellular telephone and remote radio-base station) is "conveyed" outwards of passenger compartment 1a of the vehicle in the opposite direction to the occupants, thus safeguarding the occupants from exposure to the electromagnetic wave beam, while short-range radio-frequency transmission (between the cellular telephone and on-vehicle computer) is contained within shielding case 7 which prevents any outward radiation.

[0025] On-vehicle telecommunication system 2 also has the advantage of being extremely straightforward and practical: user portable communication device 3 need simply be placed inside shielding case 7 to enable telephone communication by means of on-vehicle computer 4.

[0026] The Figure 3 embodiment relates to an on-vehicle telecommunication system 16 similar to on-vehicle telecommunication system 2, and the component parts of which are indicated, where possible, using the same reference numbers as for the corresponding component parts of on-vehicle telecommunication system 2.

[0027] Shielding case 7 of on-vehicle telecommunication system 16 is also substantially parallelepiped-shaped with a door 14 for insertion/removal of portable communication device 3, but, unlike shielding case 7 of on-vehicle telecommunication system 2, has no non-shielding window 15 permitting outward passage of the long-range radio-frequency signals generated by portable communication device 3 inside shielding case 7. In other words, shielding case 7 of on-vehicle telecommunication system 16 is fully closed, i.e. made entirely of shielding material, so as to prevent or greatly reduce outward passage of any radio-frequency signals exchanged inside between user portable communication device 3 and the remote radio-base station, and between user portable communication device 3 and communication module 9 of on-vehicle computer 4.

[0028] With reference to Figures 3 and 4, on-vehicle telecommunication system 16 comprises a second transmitting-receiving antenna 17 installed inside shielding case 7 and connected by a transmission means 18, e.g. a coaxial cable of waveguide, to a vehicle antenna 19 located outside shielding case 7 and for transmitting and receiving to and from the remote radio-base station (not shown).

[0029] In connection with the above, it should be pointed out that, by providing for full outward shielding of electromagnetic fields, shielding case 7 of on-vehicle telecommunication system 16 may advantageously be fixed anywhere inside passenger compartment 1a of vehicle 1.

[0030] Vehicle antenna 19 may be defined by the antenna fitted outside the passenger compartment of vehicle 1; while transmitting-receiving antenna 17 may be defined, for example, by a horn antenna 17a (shown schematically in the Figure 5 example) comprising, for example, an inner surface portion of a wall of shielding

case 7, or by a dipole antenna comprising, for example, an end portion of a coaxial cable connecting the dipole antenna to vehicle antenna 19, or by a capacitive antenna.

5 [0031] Clearly, changes may be made to the system as described and illustrated herein without, however, departing from the scope of the present invention.

10 [0032] In particular, as opposed to shielding case 7, the shielding environment may be defined by any housing formed inside vehicle 1.

Claims

- 15 1. A vehicle (1) equipped with an on-vehicle telecommunication system (2; 16); the on-vehicle telecommunication system (2; 16) being **characterized by** comprising shielding housing means (7) for a user portable communication device (3), which has first antenna means (6a) and first communication means (6) connected to said first antenna means (6a) to permit short-range radio-frequency transmission and reception, and second antenna means (5) permitting long-range radio-frequency transmission and reception to and from a remote radio-base station; said on-vehicle telecommunication system (2, 16) comprising third antenna means (8) installed inside said shielding housing means (7); second communication means (9) connected to said third antenna means (8) to permit, inside said shielding housing means (7), short-range radio-frequency communication with said first communication means (6) of said user portable communication device (3); and user interface means (10), which are installed in said vehicle (1), are connected to said second communication means (9), and permit remote use by a user of said user portable communication device (3) to effect said long-range radio-frequency transmission and reception.
2. A vehicle as claimed in Claim 1, **characterized in that** said shielding housing means (7) comprise a window (15) transparent to radio-frequency signals and so oriented as to permit passage of the radio-frequency signals outwards of the vehicle (1).
3. A vehicle as claimed in Claim 2, **characterized in that** said window (15) is defined by a closed opening made of non-shielding material transparent to radio-frequency signals.
4. A vehicle as claimed in Claim 2, **characterized in that** said window (15) is defined by an opening formed in the body of said shielding housing means (7).
5. A vehicle as claimed in any one of Claims 2 to 4, **characterized in that** said shielding housing

means (7) comprise a shielding case (7) fixed integrally to a wall of said vehicle (1) transparent to said radio-frequency signals.

6. A vehicle as claimed in Claim 5, **characterized in that** said shielding case (7) is fixed integrally to the windscreen (1b) of said vehicle (1). 5
7. A vehicle as claimed in Claim 6, **characterized in that** said shielding case (7) is positioned with said window (15) facing said windscreen (1b) of said vehicle (1). 10
8. A vehicle as claimed in Claim 1, **characterized in that** said shielding housing means (7) are closed. 15
9. A vehicle as claimed in Claim 8, **characterized by** comprising fourth antenna means (17) installed inside said shielding housing means (7) and connected to fifth antenna means (19) located in said vehicle (1) and outside said shielding housing means (7); said fourth antenna means (17) permitting transmission and reception to and from said second antenna means (5) of said user portable communication device (3). 20 25
10. A vehicle as claimed in Claim 9, **characterized in that** said fifth antenna means (19) comprise a vehicle antenna. 30
11. A vehicle as claimed in Claims 9 or 10, **characterized in that** said fourth antenna means (17) comprise a horn antenna (17a). 35
12. A vehicle as claimed in Claims 9 or 10, **characterized in that** said fourth antenna means (17) comprise a dipole antenna. 40
13. A vehicle as claimed in Claims 9 or 10, **characterized in that** said fourth antenna means (17) comprise a capacitive antenna. 45
14. A vehicle as claimed in any one of the foregoing Claims, **characterized in that** said shielding housing means (7) comprise at least one door (14) by which to insert/remove said user portable communication device (3) inside/from said shielding housing means (7). 50
15. A vehicle as claimed in any one of the foregoing Claims, **characterized in that** said interface means (10) are integrated in an on-vehicle computer (4) of said vehicle (1), and **in that** said second communication means (9) are integrated in said on-vehicle computer (4). 55
16. A vehicle as claimed in any one of Claims 1 to 14, **characterized in that** said second communication

means (9) are fixed to said shielding housing means (7) .

17. A vehicle as claimed in any one of the foregoing Claims, **characterized in that** said first (6) and said second (9) communication means permit radio-frequency communication to the Bluetooth or IEEE 802.11b short-range communication standard.
18. A vehicle as claimed in any one of the foregoing Claims, **characterized in that** said user portable communication device (3) is a cellular telephone.

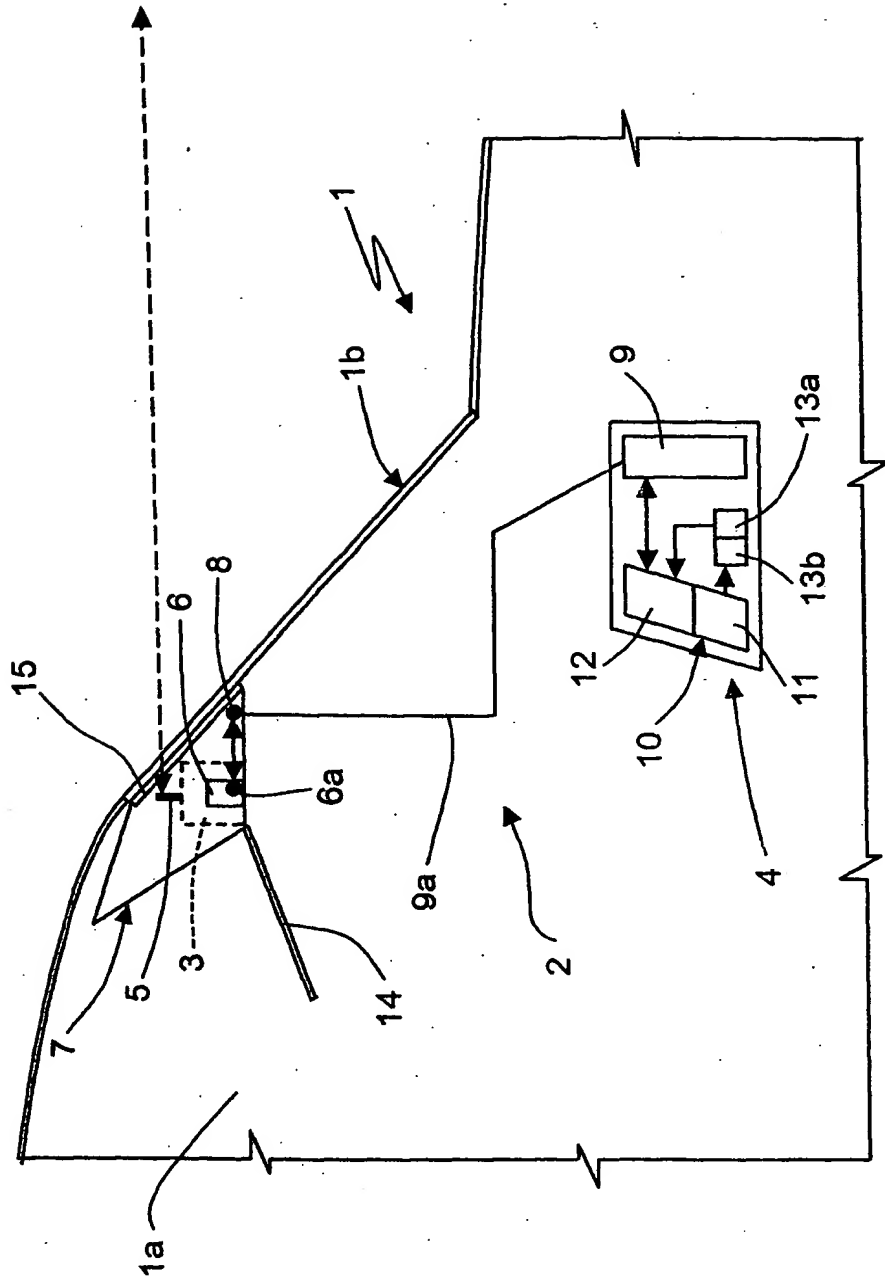


Fig.1

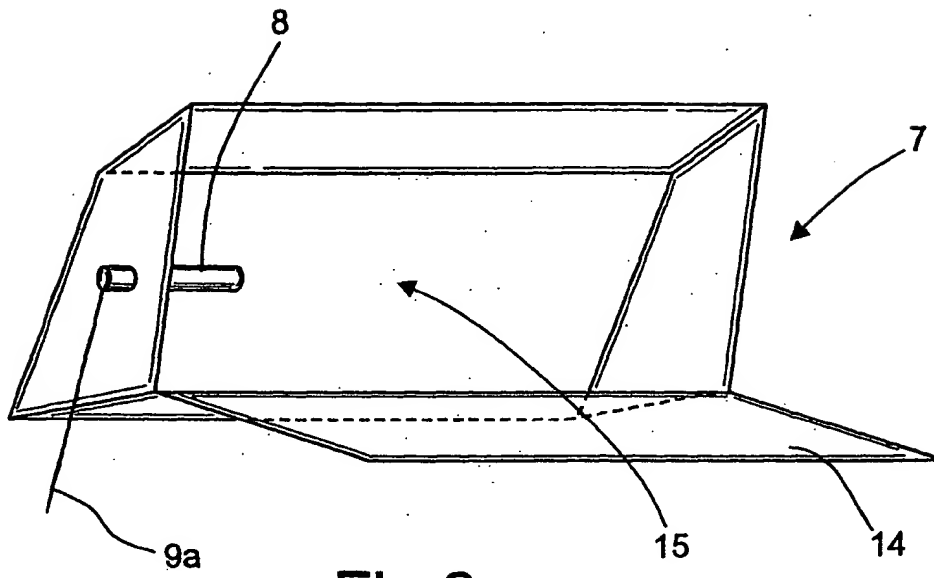


Fig. 2

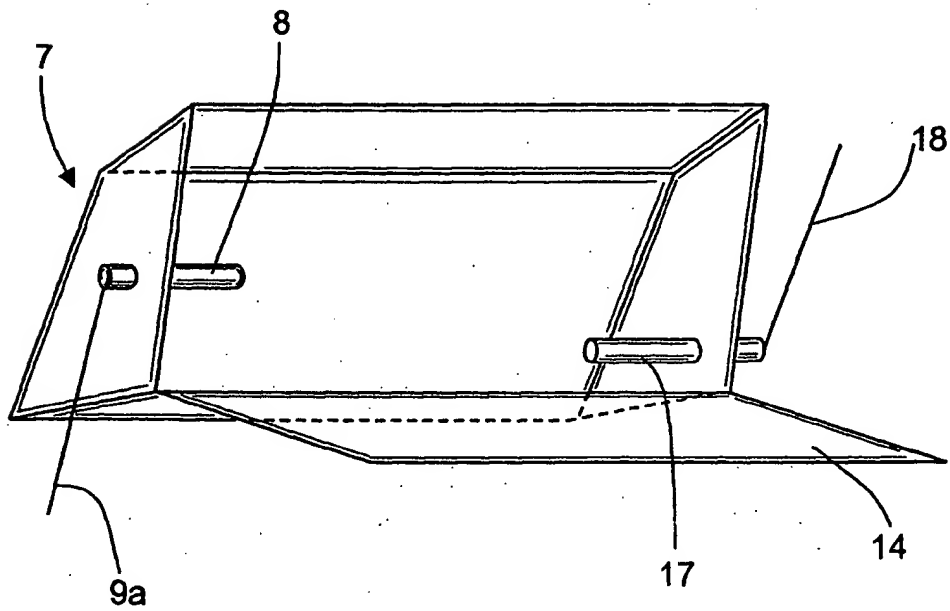


Fig. 4

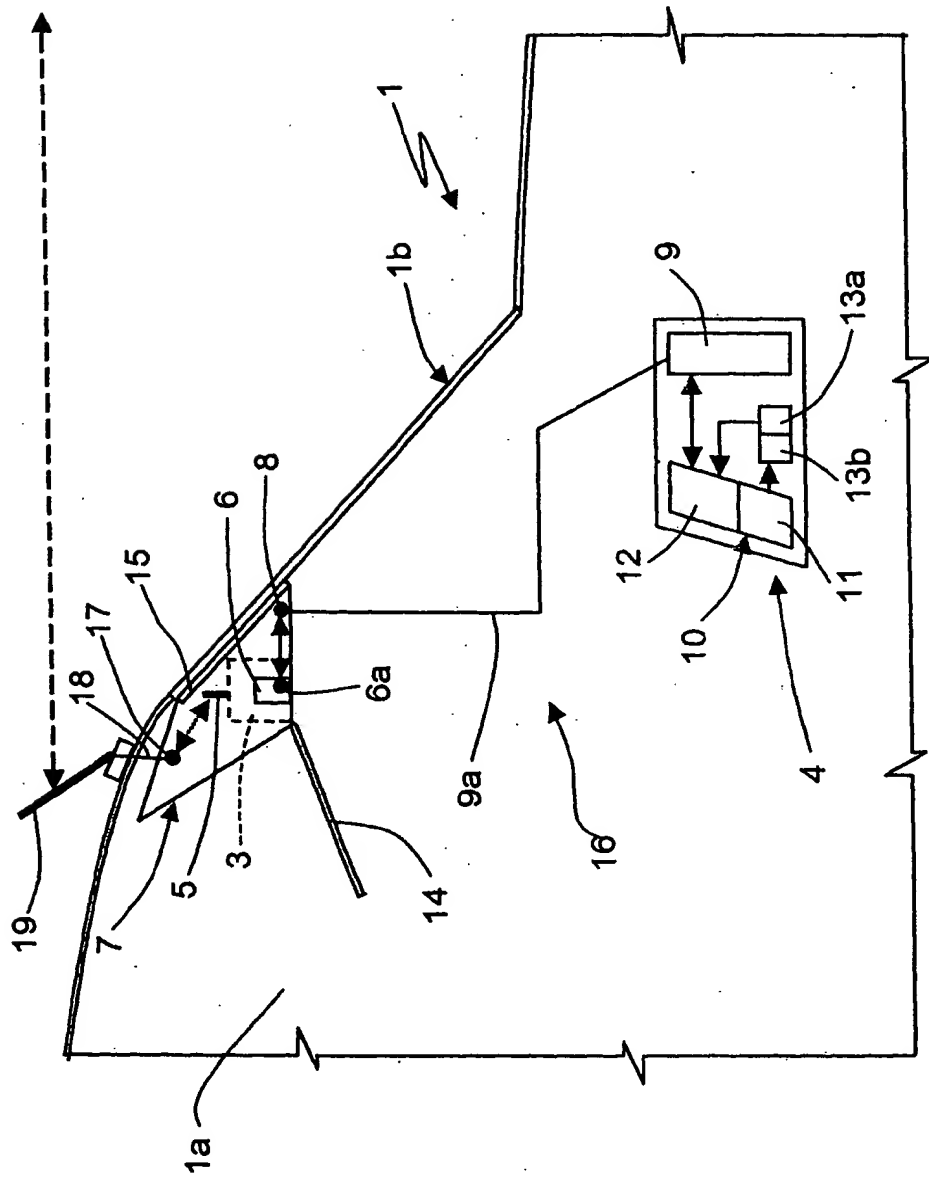


Fig. 3

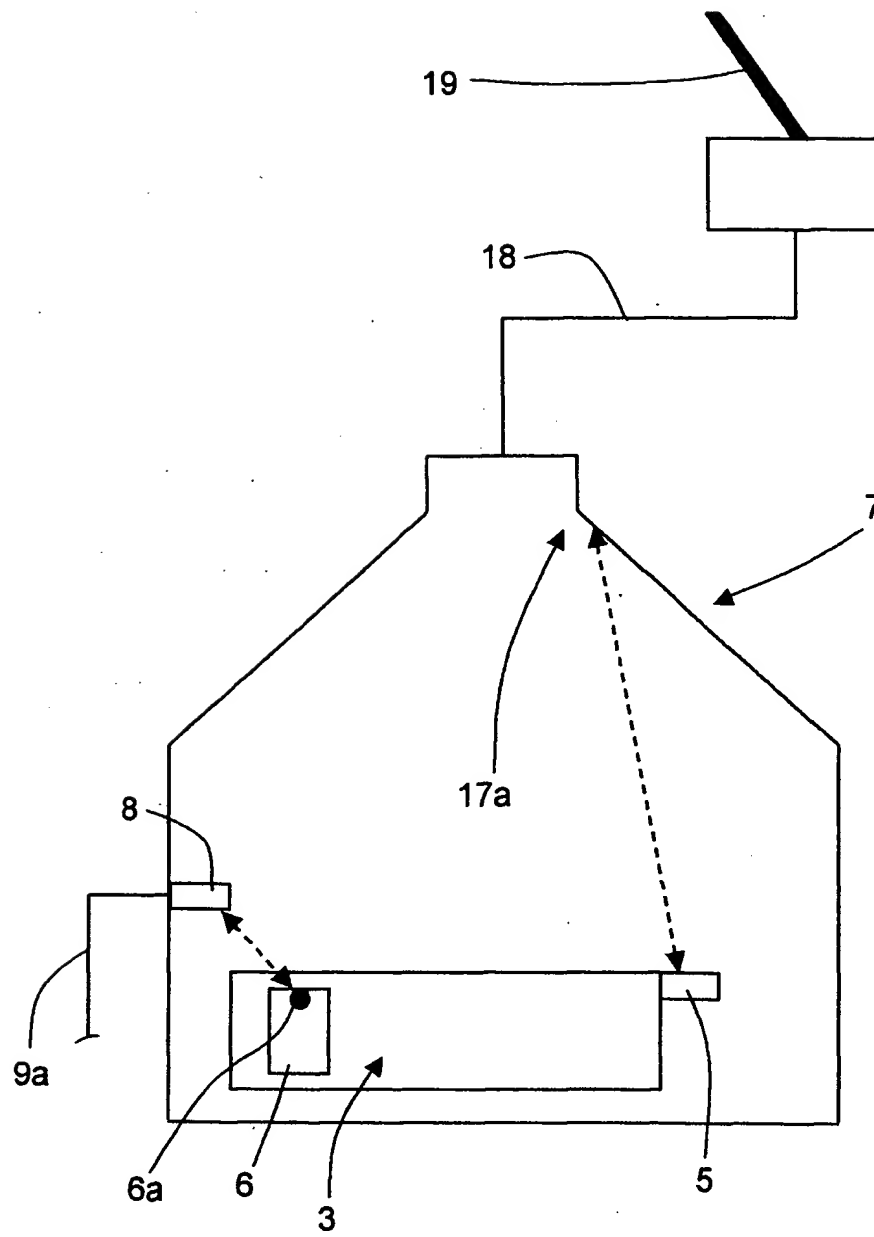


Fig.5



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EUROPEAN SEARCH REPORT

Application Number
EP 04 10 2815

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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